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Contact Hours: **2**

Bloodborne Pathogens Training

OSHA's Bloodborne Pathogens Standard

BY Judith Swan, MSN, BSN, ADN, RN; Mary C. Mitus, MSN, RN, CCAP

LEARNING OUTCOME AND OBJECTIVES: Upon completion of this continuing education course, you will have the knowledge to comply with OSHA's Bloodborne Pathogens Standard and CDC directives regarding risks and precautions associated with exposure to blood and other potentially infectious materials. Specific learning objectives include:

- State the OSHA definition for blood and other potentially infectious materials.
- Describe the employer requirements of OSHA's Bloodborne Pathogens Standard.
- Describe the chain of infection as it applies to bloodborne diseases.
- Identify bloodborne diseases of concern to healthcare providers in the United States.
- Discuss how Standard Precautions protect against bloodborne pathogens.
- Discuss types of personal protective equipment, work practices, and engineering controls that reduce risk of exposure to bloodborne pathogens.
- Identify warning labels used in cases of known hazards or suspected risk of infection.
- Summarize employer and employee actions to be taken in case of an occupational exposure to a bloodborne pathogen.

INTRODUCTION

Ensuring the safety of providers within the healthcare setting is of utmost importance. A multifaceted approach is needed to reduce the risk of occupational exposure to bloodborne pathogens. According to the Centers for Disease Control and Prevention (CDC), exposure to blood and other body fluids occurs across a wide variety of occupations, including healthcare workers, emergency responders, and public safety personnel.

Exposures can be through needlestick or other sharps injuries and mucous membrane or skin exposures. Among the various bloodborne pathogens affecting humans, those of major concern are the human immunodeficiency virus (HIV), hepatitis B virus (HBV), and hepatitis C virus (HCV). Other pathogens of concern are Ebola virus and Zika virus (CDC, 2017a).

The U.S. Exposure Prevention Information Network (EPINet) Sharps Injury and Blood and Body Fluid Exposure Surveillance Research Group collects data annually from healthcare facilities around the United States. Participating hospitals vary in size, geographic location, and teaching status. The exposure patterns, however, are very similar, suggesting a high degree of standardization among medical devices and procedures.

In 2015 there were a total of 1,133 **sharp object injury** records reviewed. Of this total:

- Nurses incurred 427 exposures.
- The next highest number (170) occurred among attending physicians.
- A total of 491 occurred in the operating and recovery rooms, and 348 in patient rooms or wards.
- A contaminated sharp object was involved in 1,011 injuries. A total of 254 of these occurred while giving an injection and 272 while suturing.
- The highest number of injury-causing devices was suture needles (270) followed by disposable syringes (235).
- Over half (541) of injuries were caused by non-safety designed needles or sharp medical devices, while 320 were caused by a safety design device.

In that same year, there were 408 **blood and body fluid exposure** records reviewed. Of this total:

- Nurses incurred 201 exposures.
- The next highest number (42) occurred among non-lab technologists.
- Over half (208) occurred in a patient room or ward.
- The majority of exposures were to blood or blood products (216).
- The barrier most commonly worn was a single pair of gloves (227).
- A total of 166 were the result of direct patient contact.
- The greatest number of exposures was to the face/head (259).
  (ISC, 2015)

Occupational exposure to bloodborne pathogens is often preventable.

OSHA BLOODBORNE PATHOGENS STANDARD

The Occupational Safety and Health Administration (OSHA), part of the U.S. Department of Labor, first published the Occupational Exposure to Bloodborne Pathogens Standard in 1991 in Title 29 of the Code of Federal Regulations 1910.1030. In 2001, in response to the Needlestick Safety and Prevention Act, OSHA revised the Bloodborne Pathogens Standard.

The Bloodborne Pathogens Standard is updated regularly, with the most recent update from April 2012 *(see "Resources" at the end of this course)*. The Standard details what employers must do to protect workers whose jobs put them at risk for exposure to blood and other potentially infectious materials. OSHA regularly inspects healthcare agencies for compliance and may fine employers if infractions are identified.

BLOOD AND OTHER POTENTIALLY INFECTIOUS MATERIALS

All occupational exposures to blood or other potentially infectious materials place healthcare providers at risk for infection with bloodborne pathogens.

OSHA defines **blood** as:

- Human blood
- Human blood components
- Products made from human blood

Other potentially infectious materials (OPIM) include:

- Semen
- Vaginal secretions
- Cerebrospinal fluid
- Synovial fluid
- Pleural fluid
- Pericardial fluid
- Peritoneal fluid
- Amniotic fluid
- Saliva in dental procedures
- Any body fluid that is visibly contaminated with blood
- All body fluids in situations where it is difficult or impossible to differentiate between body fluids

- Any unfixed tissue or organ (other than intact skin) from a human (living or dead)
- HBV- and HIV-containing cell or tissue cultures, organ cultures, and HBV- or HIV-containing culture medium or other solutions
- Blood, organs, or other tissues from experimental animals infected with HBV or HIV
- Human breast milk (implicated in transmitting HIV and HBV from mother to infant)

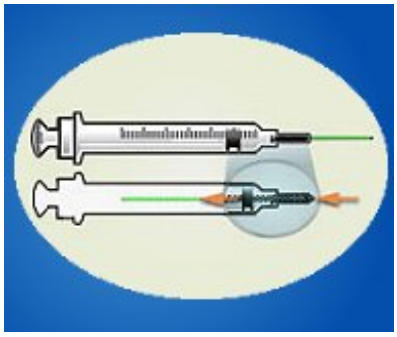
Sources: OSHA, 2012; CDC, 2015a.

In general, OSHA's Bloodborne Pathogens Standard (OSHA, 2012) requires employers to do the following:

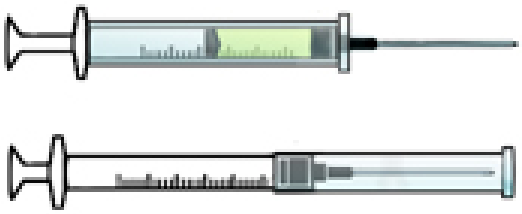
1. Establish a **written exposure control plan** designed to eliminate or minimize employee exposure to bloodborne pathogens. The employer:
    - Must prepare an exposure determination that contains a list of job classifications in which **all** workers have occupational exposure and a list of job classifications in which **some** workers have occupational exposure, along with a list of the tasks and procedures performed by those workers that could result in exposure.
    - Shall ensure that a copy of the exposure control plan is accessible to employees.
2. **Update the exposure control plan at least annually** to reflect changes in tasks, procedures, and positions that affect occupational exposure, and also technological changes implemented to eliminate or reduce occupational exposure. Employers must:
    - Annually document in the plan that they have considered and begun using appropriate, commercially available, and effective safer medical devices designed to eliminate or minimize occupational exposure.
    - Document that they have solicited input from frontline workers in identifying, evaluating, and selecting effective engineering and work practice controls.
3. Implement the use of **Universal Precautions**
    - *Universal Precautions* means treating all human blood and other potentially infectious materials as if known to be infectious for bloodborne pathogens.
    - Under circumstances in which differentiation between body fluid types is difficult or impossible, all body fluids shall be considered potentially infectious materials.
4. Identify and use **engineering controls**
    - These are devices that isolate or remove the bloodborne pathogens hazard from the workplace. They include sharps disposal containers, self-sheathing needles, and safer medical devices, such as sharps with engineered sharps-injury protection and needleless systems.

- Engineering controls shall be examined and maintained or replaced on a regular schedule to ensure their effectiveness.

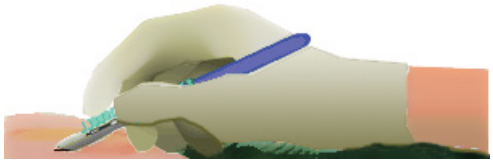
ENGINEERING CONTROL DEVICE EXAMPLES



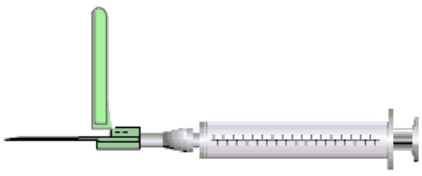
Syringe with retractable needle.



Self-resheathing needle.



Resheathing disposable scalpel.



Phlebotomy needle with hinged shield.

Source: OSHA, 2017.

5. Identify and ensure the use of **work practice controls**

    - These are practices that reduce the possibility of exposure by changing the way a task is performed, such as appropriate practices for handling and disposing of contaminated sharps, handling specimens, handling laundry, and cleaning contaminated surfaces and items.

    - Employers shall provide handwashing facilities that are readily accessible to employees. When this is not feasible, appropriate antiseptic hand cleanser in conjunction with clean cloth/paper towels or antiseptic towelettes shall be available.

    - Employers should ensure that employees wash their hands immediately or as soon as feasible after removal of gloves or other personal protective equipment.

6. Use **labels and signs to communicate hazards**

    - Warning labels must be affixed to containers of regulated waste; containers of contaminated reusable sharps; refrigerators and freezers containing blood or OPIM; other containers used to store, transport, or ship blood or OPIM; contaminated equipment that is being shipped or serviced; and bags or containers of contaminated laundry.

    - Facilities may use red bags or red containers instead of labels.

    - In HIV and HBV research laboratories and production facilities, signs must be posted at all access doors when OPIM or infected animals are present in the work area or containment module.

WARNING LABELS

Warning labels are fluorescent orange, red, or orange-red. Bags used to dispose of regulated waste must be red or orange-red, and they too must have the biohazard symbol in a contrasting color readily visible upon them.

Biohazard warning label.

Source: OSHA, 2012.

7. Provide **personal protective equipment (PPE)**, such as, but not limited to, gloves, gowns, laboratory coats, face shields or masks and eye protection, mouthpieces, resuscitation bags, pocket masks, or other ventilation devices

    - Employers must clean, repair, and replace this equipment as needed. Provision, maintenance, repair, and replacement are at no cost to the worker.

8. Make available **hepatitis B vaccinations** to all workers with occupational exposure

    - Vaccination must be offered after the worker has received the required bloodborne pathogens training and within 10 days of initial assignment to a job with occupational exposure.

9. Make available **postexposure evaluation and follow-up** to any occupationally exposed worker after an exposure incident

    - An exposure incident is a specific eye, mouth, other mucous membrane, nonintact skin, or parenteral contact with blood or OPIM.

    - Evaluation and follow-up must be at no cost to the worker and includes documenting the route(s) of exposure and the circumstance under which the exposure incident occurred; identifying and testing the source individual for HBV and HIV infectivity if the source individual consents or the law does not require consent; collecting and testing the exposed worker's blood, if the worker consents; offering postexposure prophylaxis; offering counseling; and evaluating reported illnesses.

      The healthcare professional will provide a limited written opinion to the employer and all diagnoses must remain confidential.

10. Provide **information and training** to employees that covers all elements of the standard, including, but not limited to:

    - Information on bloodborne pathogens and diseases, methods used to control occupational exposure, hepatitis B vaccine, and medical evaluation and postexposure follow-up procedures.

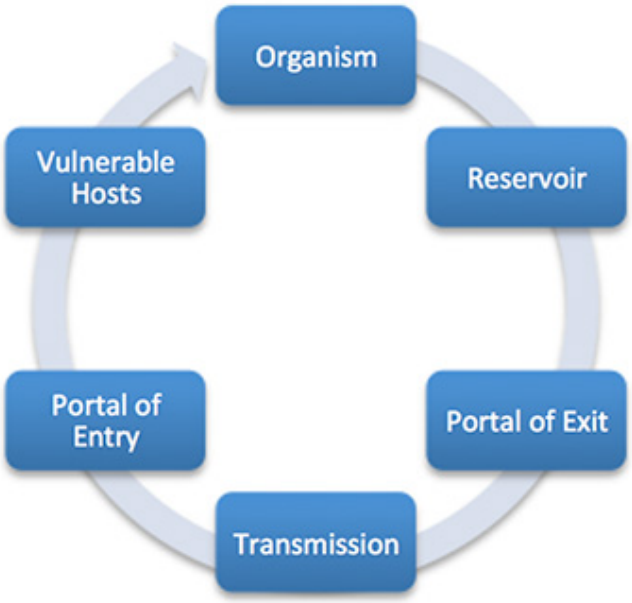
    - Employers must offer this training on initial assignment, at least annually thereafter, and when new or modified tasks or procedures affect a worker's occupational exposure.

    - HIV and HBV laboratory and production facility workers must receive specialized initial training in addition to the training provided to all workers with occupational exposure. Workers must have the opportunity to ask the trainer questions. Training must be presented at an educational level and in a language that workers understand.

11. Maintain employee **training and medical records** including a sharps injury log

CHAIN OF INFECTION

The process of transmission of an infectious agent can be best explained by the epidemiologic model called the *chain of infection.* An infectious disease results from specific interactions between the agent, host, and environment. Transmission occurs when the infectious agent leaves the reservoir or host through a portal of exit, travels by some mode of transmission, and enters through a portal of entry to infect a susceptible host (CDC, 2012).



Chain of infection.
(Source: Wild Iris Medical Education, Inc.)

- **Infectious organisms** can be bacteria, viruses, fungi, or parasites.
- A **reservoir** of an infectious agent is the habitat where the agent normally lives and grows. Reservoirs may be dirty surfaces and equipment, humans, animals/insects, or soil. In the case of bloodborne infectious diseases, humans are generally the reservoirs.
- The **portal of exit** is the path by which the infectious agent leaves its host. This can occur through open wounds/skin, the splatter of body fluids, aerosols, or needle or other sharps contamination.
- Means of **transmission** is the mode by which the infectious agent is transmitted from its natural reservoir to a susceptible host. Transmission can occur by a mode that is direct (e.g., OPIM exposure from the reservoir patient directly to exposed nonintact skin or mucous membrane of the host) or indirect (e.g., needlestick).
- The **portal of entry** refers to the way in which the infectious agent enters the host. The portal of entry must provide access to tissues in a way that allows the infectious agent to

multiply and thrive. Portal of entry for bloodborne pathogens can include broken or punctured skin, incisions, mucous membranes, and across the placenta to fetus.

- The final link is the **vulnerable host**. Susceptibility of a host depends on many factors, including immunity and the individual's ability to resist infection. (APIC, 2016)

By breaking any link of the chain of infection, healthcare professionals can prevent the occurrence of new infection. Infection prevention measures are designed to break the links and thereby prevent new infections. The chain of infection is the foundation of infection prevention.

THE PATHOGENS

Bloodborne pathogens are microorganisms present in human blood or OPIM that can cause disease in humans. Many are relatively rare, such as malaria, syphilis, Zika virus, and Ebola virus. Others are more common, such as the hepatitis B and C viruses, which cause inflammation of the liver, and the human immunodeficiency virus (HIV), which causes acquired immunodeficiency syndrome (AIDS) (OSHA, 2012).

Hepatitis B Virus (HBV)

Hepatitis B is an infection of the liver caused by the hepatitis B virus. For some people, hepatitis B is an acute or short-term illness that typically lasts for several weeks but can persist for up to six months. For others, however, hepatitis B infection can become a chronic, long-term infection. The risk for chronic infection is related to age at infection, with about 90% of infected infants becoming chronically infected compared to 95% of adults who recover completely from HBV infection and do not become chronically infected.

In the United States in 2015, a total of 3,370 cases of acute hepatitis B were reported. The overall incidence rate for 2015 was 1.1 cases per 100,000 population. During that same year, 4,416 chronic hepatitis B cases were reported and 1,715 people died from it (CDC, 2017b). The rate of new cases of hepatitis B has decreased by approximately 82% since 1991. The decline has been greatest among children born since 1991, when routine HBV vaccination of children was implemented (CDC, 2016a).

An estimated 850,000 to 2.2 million persons in the United States have chronic hepatitis B virus infection, and it is an even greater problem globally. Around the world there are approximately 240 million persons with chronic hepatitis B, and an estimated 786,000 persons worldwide die from HBV-related liver disease every year (CDC, 2016a).

TRANSMISSION

HBV is **transmitted** through activities that involve percutaneous (i.e., puncture through the skin) or mucosal contact with infectious blood or body fluids (e.g., semen or saliva), including:

- Sex with an infected partner
- Injection drug use that involves sharing needles, syringes, or drug-preparation equipment
- Birth to an infected mother
- Contact with blood or open sores of an infected person
- Needlesticks or sharp instrument exposures
- Sharing items such as razors or toothbrushes with an infected person

Hepatitis B is **not transmitted** through:

- Breastfeeding
- Sharing eating utensils
- Hugging, kissing, holding hands
- Coughing or sneezing
- Contaminated food or water (unlike some other forms of hepatitis)

HBV is very resilient and can survive outside the body at least seven days and still be capable of causing infection. For this reason, the virus is a concern for medical personnel such as nurses, laboratory technicians, and paramedics, as well as custodians, laundry personnel, and other employees who may come in contact with blood or other potentially infectious materials (CDC, 2016a).

HBV VACCINE

The hepatitis B vaccine is the best protection from the disease. All employees who may possibly be exposed to blood or other potentially infectious materials as part of their job duties are eligible to be vaccinated against HBV.

The OSHA Bloodborne Pathogens Standard requires employers to offer the vaccination series to all workers who have occupational exposure. The vaccine and vaccination must be offered at no cost to the employee and at a reasonable time and place (OSHA, 2012).

The vaccination consists of a series of three injections. The second injection should be given one month after the first, and the third injection six months after the initial dose. To ensure immunity, it is important to receive all three injections. The vaccine causes no harm to those who are already immune or to those who may be HBV carriers.

Although employees may opt to have their blood tested for antibodies to determine the need for the vaccine, their employers may not make such screening a condition of receiving vaccination, nor are employers required to provide screening. For employees at risk for exposure, an antibody

titer can be drawn one to two months after the vaccination series is completed to determine vaccine effectiveness. If a second vaccine series is indicated, it must be offered free of charge.

Employees who decide to decline vaccination must complete a mandatory declination form. An employee may opt to take the vaccine at any time even after initially declining it (OSHA, 2012).

POSTEXPOSURE MANAGEMENT

Following an exposure to HBV, prophylaxis can prevent HBV infection and subsequent development of chronic liver infection. The central component of postexposure prophylaxis is hepatitis B vaccine. In certain circumstances, hepatitis B immune globulin is recommended in addition to vaccine for added protection.

Hepatitis C Virus (HCV)

Hepatitis C is a serious infection of the liver caused by the hepatitis C virus, a bloodborne pathogen. An estimated 2.7 to 3.2 million people in the United States have chronic hepatitis C. Most are unaware of their infection. HCV infection is the most common bloodborne chronic infection in the United States.

Prior infection does not protect against future infection with the same or different genotype of virus. At this time there is no vaccine available for hepatitis C prevention (CDC, 2017c).

TRANSMISSION

Hepatitis C transmission occurs mainly through large or repeated percutaneous exposures to infectious blood, such as injection drug use, the most common means of transmission in the United States. Due to screening methods, it rarely occurs in the United States today with the receipt of donated blood, blood products, and organs. Other methods of transmission include needlesticks in healthcare settings and being born to an HCV-infected mother (CDC, 2017c).

POSTEXPOSURE MANAGEMENT

There is no postexposure prophylaxis currently available or approved for HCV prevention. Following exposure, initial management recommendations are:

- The exposed individual should receive initial follow-up testing for HCV viral load (HCV RNA) at six weeks postexposure if the source person is HCV positive or has potential HCV risk factors.
- The exposed individual should have baseline HCV antibody (HCV Ab) testing with final follow-up testing at six months or later if the source person's HCV status is unknown or if the source person's status is known and has no known HCV risk factors. Optional testing can be done at six weeks for HCV viral load (CCC, 2017; CDC, 2016b).

Human Immunodeficiency Virus (HIV)

Human immunodeficiency virus spreads via certain body fluids and attacks the body's immune system, specifically the $CD4^+$ T cells. Untreated HIV reduces the number of T cells in the body, which makes it more and more difficult for the body to fight off infections and other diseases. Opportunistic infections or cancers take advantage of a very weak immune system and are signs that a person has AIDS.

TRANSMISSION

HIV is transmitted most commonly in the United States through sexual behaviors and sharing of needles, syringes, or equipment used to prepare drugs for injection. HIV can live in a used needle up to 42 days depending on temperature and other factors.

Less commonly, HIV may be transmitted from mother to child during pregnancy, birth, or breastfeeding and by being stuck with an HIV-contaminated needle or other sharp object, a risk mainly for healthcare workers.

In very rare instances, HIV has been transmitted by:

- Oral sex
- Blood transfusions, blood products, or organ/tissue transplants
- Eating food that has been prechewed for an infant by a caregiver
- Through broken skin after being bitten by a person with HIV
- Contact between broken skin, wounds, or mucous membranes and HIV-infected blood or blood-contaminated body fluids
- Deep, open-mouth kissing if both partners have sores or bleeding gums

For healthcare workers, the risk of occupational exposure is very low. The main risk is from being stuck with an HIV-contaminated needle or other sharp object. This risk, however, is small and estimated to be less than 1%.

As there is no vaccine to prevent HIV infection, adhering to Standard Precautions is the most effective means of protection against transmission (CDC, 2017d).

POSTEXPOSURE MANAGEMENT

Occupational exposures require urgent medical evaluation. Baseline HIV testing of the exposed worker should be done even if the exposed worker refuses postexposure prophylaxis (PEP) treatment.

PEP should be initiated as soon as possible, ideally within two hours of exposure. A first dose

of PEP should be offered while evaluation is underway and should not be delayed while awaiting information about the source person or results of the exposed worker's baseline HIV test.

Whether the exposed worker accepts or declines PEP treatment, if postexposure evaluation shows that PEP is indicated, repeat HIV testing should be done at 4 and 12 weeks. If test results at 12 weeks are negative, HIV can reasonably be excluded in relation to an occupational exposure.

Currently, the preferred HIV three-drug occupational postexposure prophylaxis regimen is Truvada orally once a day plus raltegravir orally twice a day or dolutegravir once a day for a duration of 28 days. If source person testing is found to be negative for HIV, PEP can be discontinued before 28 days (CCC, 2017).

Ebola Virus

Ebola, previously known as Ebola hemorrhagic fever, is a rare and deadly disease caused by one of the Ebola virus strains. Ebola virus disease (EVD) is often fatal if untreated. There are five identified Ebola virus species, four of which are known to cause disease in humans.

EVD was originally discovered in Africa in 1976 near the Ebola River in the Republic of Congo. The natural host of the Ebola virus is thought to be animal-borne, specifically tied to bats. Since the discovery of the Ebola virus, periodic outbreaks have occurred. In 2014, a large and serious epidemic outbreak occurred, with spread of the disease from Africa to other countries, including the United States (CDC, 2014).

TRANSMISSION

The Ebola virus is transmitted through direct contact (broken skin or mucous membranes) with:

- Blood or body fluids of a person who has Ebola or has died from Ebola
- Contaminated objects such as needles and syringes, surfaces, bedding, or clothing
- Infected fruit bats or primates
- Possibly from contact with semen from a man who has recovered from Ebola

Ebola virus can survive outside the host for a significant length of time—as long as a couple of days—at room temperature and is known to exist in people who have recovered from EVD in sites such as the testicles, the inside of the eye, and the central nervous system. In women who have been infected while pregnant, the virus persists in the placenta, amniotic fluid, and fetus. In women who have been infected while breastfeeding, the virus may persist in breast milk.

Healthcare workers have frequently been infected while treating patients with suspected or confirmed Ebola virus disease through close contact when infection control precautions have not been practiced (CDC, 2017e; WHO, 2017a).

There is no Ebola virus vaccine available as yet; however, an experimental Ebola vaccine proved highly protective against the virus in a major trial in Guinea (WHO, 2017a).

POSTEXPOSURE MANAGEMENT

There are no FDA-approved vaccines or therapeutics available for EVD prevention or postexposure.

During the 2014 Ebola outbreak, the CDC issued the *Interim U.S. Guidance for Monitoring and Movement of Persons with Potential Ebola Virus Exposure*, which stated that even though U.S. healthcare workers who care for Ebola patients follow all the recommended PPE guidelines, they are considered to be at low risk (but not zero) because they may not realize they have been exposed. Therefore, it was recommended that they be actively monitored.

Active monitoring means:

- Public health officials are responsible for checking at least once a day to see if the person has a fever or other symptoms of Ebola.
- People being monitored must take their temperature twice daily, watch themselves for symptoms, report as directed to public health officials, and immediately notify them if a fever or other symptoms are present.
- Active monitoring must take place until 21 days after the last possible exposure and can occur on a voluntary basis or be required by public health order to be directly monitored.

Healthcare workers who were exposed through direct contact with infected body fluids were to be directly monitored by public health officials and be restricted from public activities and travel.

This guidance was retired in 2016, but the CDC will consider similar guidance during future outbreaks, taking into account the extent of the outbreak and the risk of importation and spread of disease into the United States (CDC, 2016c).

Zika Virus

Zika virus disease is caused by the Zika virus (*Aedes aegypti* and *Aedes albopictus*), which is found worldwide. Although the illness is usually mild, Zika infection during pregnancy can cause serious birth defects such as microcephaly (smaller than normal head) as well as absent or poorly developed brain structures, defects of the eye, hearing deficits, and impaired growth. Zika is also a trigger of Guillain-Barré syndrome, a rare condition resulting in near to total paralysis and/or death if severe (WHO, 2017b).

TRANSMISSION

Zika virus is primarily spread through the bites of infected mosquitoes. Mosquitoes can become infected when they bite infected persons and can then spread the Zika virus to other persons they subsequently bite. Other modes of transmission:

- While rare, during pregnancy and through the birthing process
- Sexual contact (Zika virus can stay in semen longer than in other body fluids)
- Blood transfusion
- Bloodborne exposure

Workers who are exposed on the job to mosquitoes or have direct contact with infectious blood or other body fluids, such as those exposed to large volumes of body fluids of Zika-infected women during labor and delivery, are at risk for occupationally acquired Zika virus infection (OSHA, 2016).

POSTEXPOSURE MANAGEMENT

Healthcare workers who believe an occupational exposure has occurred should report it immediately to the supervisor and follow the employer's procedures. This usually involves contacting the occupational health office for an assessment of the exposure with consideration of all bloodborne pathogens.

If it is determined that an occupational exposure did occur, testing might be indicated; however, this needs to be determined individually along with public health authorities and will depend on the type of exposure, infectious status of the source patient, and individual healthcare personnel factors, including pregnancy status (CDC, 2017f).

EXPOSURE PREVENTION

It is important for all healthcare workers to understand the role they play in protecting themselves, coworkers, patients, and families from exposure to bloodborne pathogens. The employer's exposure control plan provides the following detailed information about how each healthcare worker can take appropriate steps to reduce or eliminate the risk of exposure to bloodborne pathogens as well as other infectious agents.

Universal and Standard Precautions

Universal Precautions is the term used to describe a prevention strategy in which all blood and OPIM are treated as if they are actually infectious, regardless of the perceived status of the source individual. In other words, whether or not one thinks the blood/body fluid is infected with bloodborne pathogens, treat it as if it is. This approach is used in all situations where exposure to

blood or OPIM is possible. In addition, it means that certain engineering and work practice controls are always utilized in situations where exposure may occur.

OSHA's Bloodborne Pathogens Standard allows for healthcare facilities to use acceptable alternatives to Universal Precautions. The CDC revised the infection control practice from Universal Precautions to Standard Precautions in 1996. Standard Precautions combine the major features of Universal Precautions with Body Substance Isolation (BSI). **Standard Precautions incorporate not only the fluids and materials covered by the Bloodborne Pathogens Standard but expand coverage to include any and all body fluids and substances** (OSHA, 2012).

These precautions are intended to address all modes of transmission by any type of organism. Routes of transmission include:

- **Contact** (direct or indirect):
    - Direct contact is transfer of microorganisms from one infected person to another without a contaminated intermediate object or person (e.g., blood splatter).
    - Indirect contact involves transfer of an infectious agent though a contaminated intermediate object or person (e.g., needlestick, other sharp object). Contaminated hands of healthcare personnel are important contributors to indirect contact transmission.
- **Droplet:** Transmission of infection (e.g., influenza virus) traveling directly from the respiratory tract of infectious individuals to susceptible mucosal surfaces of the recipient, generally over short distances, necessitating facial protection.
- **Airborne:** Transmission by dissemination of either airborne droplet nuclei or small particles containing infectious agents (e.g., *Myobacterium tuberculosis*) that remain infective over time and distance, requiring the use of special air handling and ventilation systems.
  (CDC, 2016d)

Standard Precautions for Bloodborne Pathogens

The Standard Precautions that are to be followed by all healthcare workers when concerned with bloodborne pathogens or other potentially infectious materials include:

1. Performing hand hygiene
2. Using personal protective equipment (PPE) whenever there is an expectation of possible exposure to infectious material
3. Proper handling and proper cleaning and disinfecting of patient care equipment and instruments/devices; appropriate cleaning and disinfecting of the environment
4. Handling textiles and laundry carefully

5. Ensuring healthcare safety by proper handling of regulated waste, including proper handling of needles and other sharps
(CDC, 2017g)

HAND HYGIENE

Hand hygiene is the first line of defense, the single most important practice in the preventing the spread of infectious agents. Hand hygiene in Standard Precautions means cleaning the hands with either soap and water, antiseptic hand wash/rub, or surgical hand antisepsis. Hand hygiene is done to reduce the spread of potentially infectious agents from healthcare workers to patients and from patients to healthcare workers.

Hand hygiene should be performed:

- Before eating
- Before and after having direct contact with a patient's intact skin
- After contact with blood, body fluids or excretions, mucous membranes, nonintact skin, or wound dressings
- After contact with inanimate objections (including medical equipment) in the immediate vicinity of the patient
- When hands will be moving from a contaminated body site to a clean body site during patient care
- After glove removal
- After using a restroom
(CDC, 2017g)

HAND HYGIENE WITH SOAP AND WATER OR HAND SANITIZER

The CDC guidelines for hand hygiene in healthcare settings recommend:

When using soap and water:

- Wash hands first with water.
- Apply the amount of product recommended by manufacturer to hands.
- Rub hands together vigorously for at least 15 to 20 seconds, covering all surfaces of hands and fingers.
- Rinse hands with water and use disposable towels to dry. Use a clean paper towel to turn off the faucet.
- Avoid using hot water to prevent drying of the skin.

When using an alcohol-based hand sanitizer:

- Put product on hands and rub hands together.
- Cover all surfaces until hands feel dry.
- Total time should be 20 seconds.

Source: CDC, 2017g.

PERSONAL PROTECTIVE EQUIPMENT (PPE)

Personal protective equipment is defined by OSHA as specialized clothing or equipment worn by a healthcare worker for protection against infectious materials. Employers are required to provide and maintain clean, appropriate PPE and clothing free of charge to employees. Latex-free PPE must be made available on request.

PPE must be readily accessible to employees and available in appropriate sizes. It is important to know which type of PPE is available at work and where it is stored. To protect oneself, healthcare providers must have a barrier between them and any potentially infectious material.

Types of PPE used in healthcare settings include:

- Gloves
- Gowns/aprons/coveralls
- Face and eye protection
- Head coverings
- Boots/shoe covers
- Respirators

Factors that influence the **selection of appropriate PPE** include:

- Type of exposure anticipated
    - Splash/spray versus touch
    - Category of isolation precautions (Contact, Droplet, Airborne)
- Durability and appropriateness for the task
- Fit of the equipment

Gloves

Gloves are the most common type of PPE. They are used for patient care as well as environmental service. Gloves can be sterile or nonsterile and single use or reusable. Because of allergy concerns, latex products have been eliminated in many facilities, and materials used for gloves are mostly synthetics such as vinyl or nitrile.

Most patient care activities require the use of a single pair of nonsterile gloves. Sterile surgical gloves are worn when performing invasive patient procedures. At times two pairs of gloves may be worn for additional protection during surgical procedures. Environmental service personnel often wear reusable heavy-duty gloves to work with caustic disinfectants.

Proper glove use includes:

- Working from clean to dirty
- Limiting touch contamination (e.g., adjusting eyeglasses, touching light switches, etc.) when wearing gloves that have been in contact with a patient
- Changing gloves during use if torn or when heavily soiled, and after use on each patient
- Disposing of gloves in a proper receptacle
- Performing hand hygiene before putting on and following removal of gloves
- Never washing or reusing disposable gloves
  (CDC, 2017g)

Gowns/Aprons/Coveralls

Isolation gowns are preferred, but aprons occasionally are used where limited contamination is expected. Gowns should fully cover the torso, fit comfortably over the body, and have long sleeves that fit snugly at the wrist.

Clean gowns are generally used for isolation precautions. Sterile gowns are only needed when performing invasive procedures.

A waterproof apron is often worn during surgical or obstetrical procedures when a large volume of blood or body fluids are anticipated.

Coveralls provide 360-degree protection and are designed to cover the whole body, including back and lower legs, and sometimes head and feet as well (CDC, 2017g).

Face and Eye Protection

Face and eye protection are used during patient care activities likely to generate splashes or sprays of blood, body fluids, secretions, or excretions.

- **Masks** protect the nose and mouth and should fully cover them to prevent fluid penetration.
- **Goggles** protect the eyes and should fit over and around them snuggly. Personal prescription glasses are not a substitute for goggles. Some goggles have antifog features that improve clarity.
- **Face shields** protect the face, nose, mouth, and eyes. A face shield should cover the forehead, extend below the chin, and wrap around the sides of the face. (CDC, 2017g)

Head Coverings

Head coverings such as surgical caps are worn when gross contamination is expected, such as during orthopedic surgery or autopsies (OSHA, 2012).

Boots/Shoe Covers

Theater boots are waterproof boots worn by surgical personnel as a protective measure from contamination with blood and other body fluids. Shoe covers protect the wearer from accidental spills and bodily fluids (OSHA, 2012).

Respirators

Respirators protect the healthcare worker from inhalation of infectious aerosols. These include:

- **Particulate respirators (N-95)** to protect against particles (dust and infectious agents) but not vapor or gas
- **Half- or full-face elastomeric respirators** to protect against particulates as well as gases and vapors
- **Powered air purifying respirators (PAPR)**, which use a battery-powered blower to force air through a high-efficiency particulate air (HEPA) filter for the wearer to breathe
(CDC, 2017h)

Respirators require medical evaluation in order to determine if it is safe for the healthcare worker to wear a respirator as well as to fit the worker with the appropriate respirator size and type. The healthcare worker must also be trained on how and when to use the

respirator. Following training, the healthcare worker is responsible for checking the respirator before use to ensure it has a proper seal (CDC, 2017h).

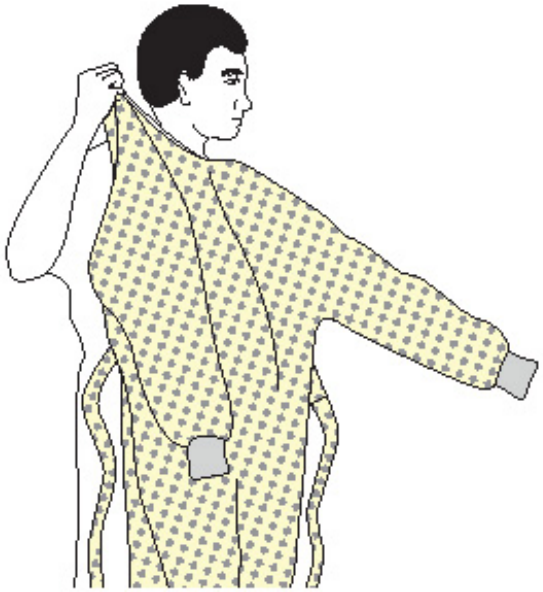
PUTTING ON PPE

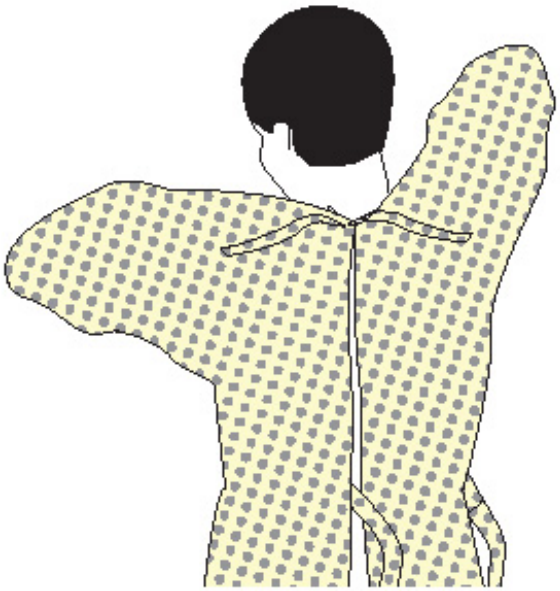
PPE should be put on (donned) in the following sequence:

1. Gown
2. Mask
3. Face shield or goggles
4. Gloves

How to put on a gown:

1. Select appropriate type and size.
2. Put on with opening in the back.
3. Secure at neck and waist.
4. If gown is too small, use two gowns, with the first tied in front, the second tied in back.





How to put on a mask:

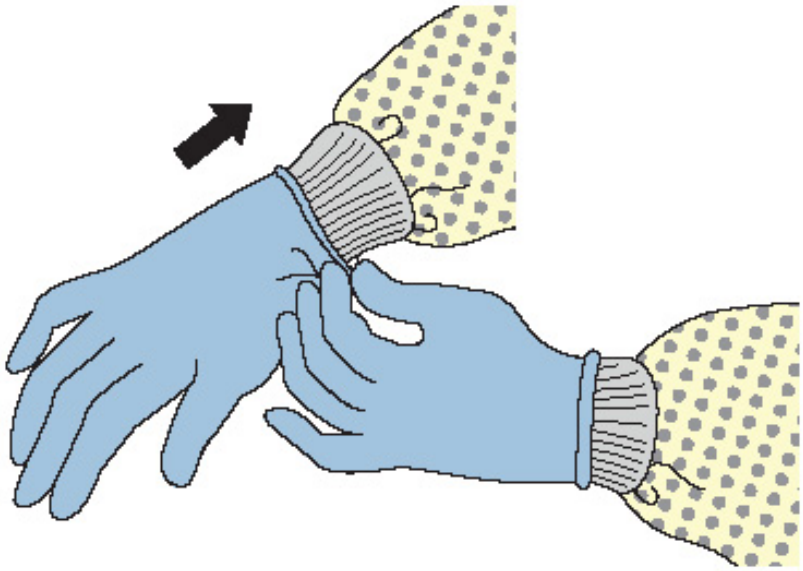
1. Place over nose, mouth and chin.
2. Fit flexible nose piece over bridge of nose.
3. Secure on head with ties or elastic.

How to put on goggles and face shield:

1. Place over face and eyes.
2. Adjust to fit.

How to put on gloves:

1. Select correct type and size.
2. Insert hands into gloves.
3. Extend gloves over isolation gown cuffs.



Source: CDC, 2016e.

REMOVING PPE

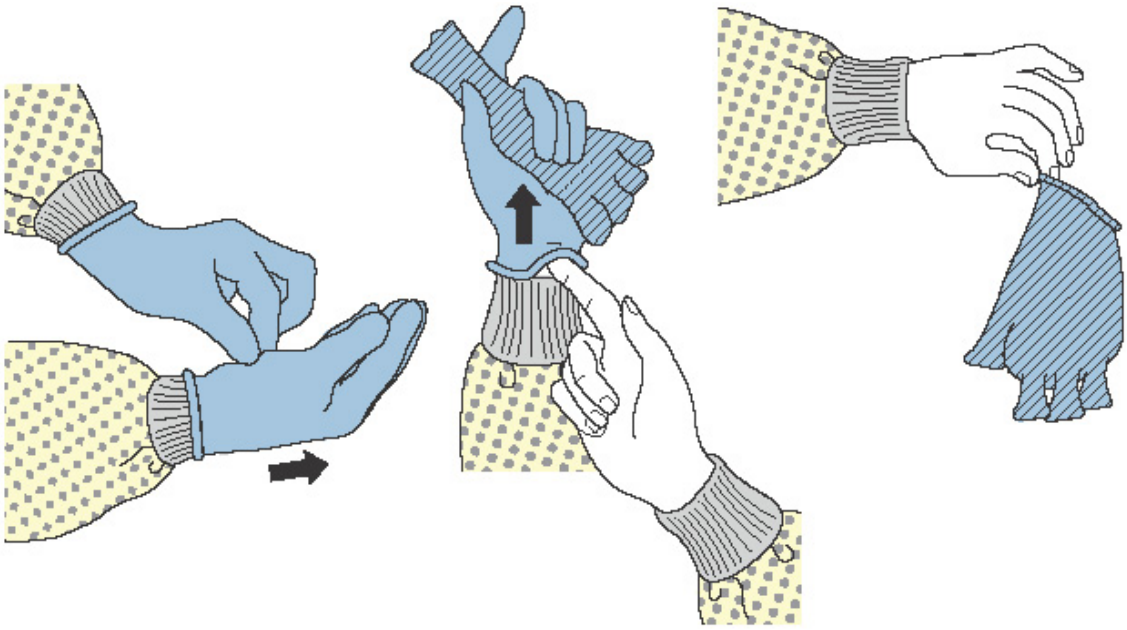
Contaminated PPE should be removed in the following sequence:

1. Gloves
2. Face shield or goggles
3. Gown
4. Mask or respirator

They should be removed at the doorway before leaving the patient room or in the anteroom. Respirators should be removed outside the room after the door has been closed.

How to remove gloves:

1. Grasp outside edge near wrist.
2. Peel away from hand, turning glove inside out.
3. Hold in opposite gloved hand.
4. Slide ungloved finger under wrist of remaining glove.
5. Peel off from inside, creating a bag for both gloves.
6. Discard.
7.

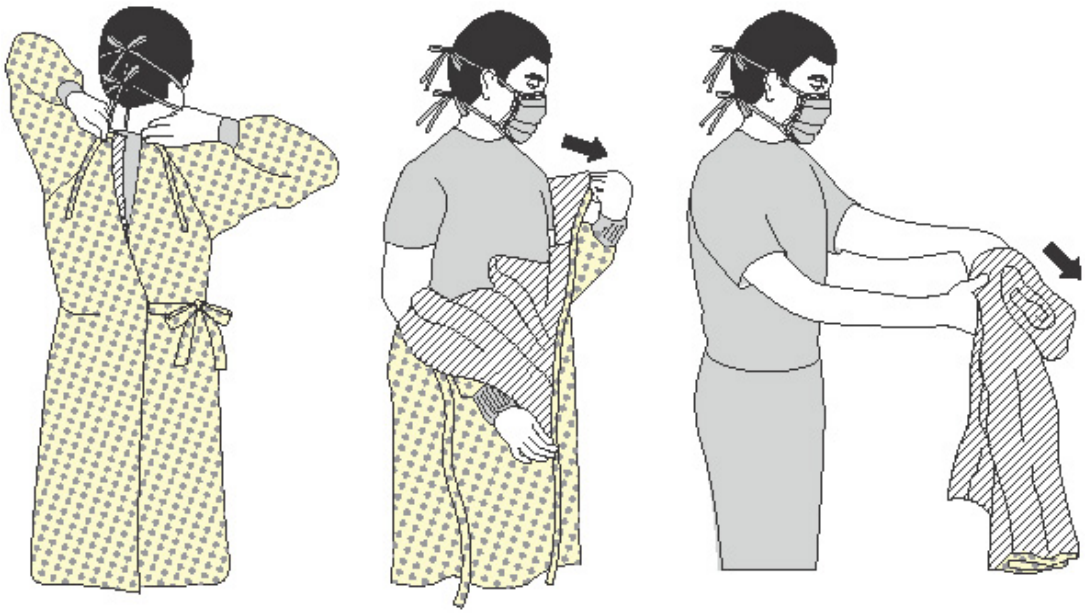


How to remove goggles or face shield:

1. Outside of goggles or face shield are contaminated.
2. Remove from the back by lifting head band or ear pieces.
3. Lift away from face.
4. Place in designated receptacle for reprocessing or disposal.

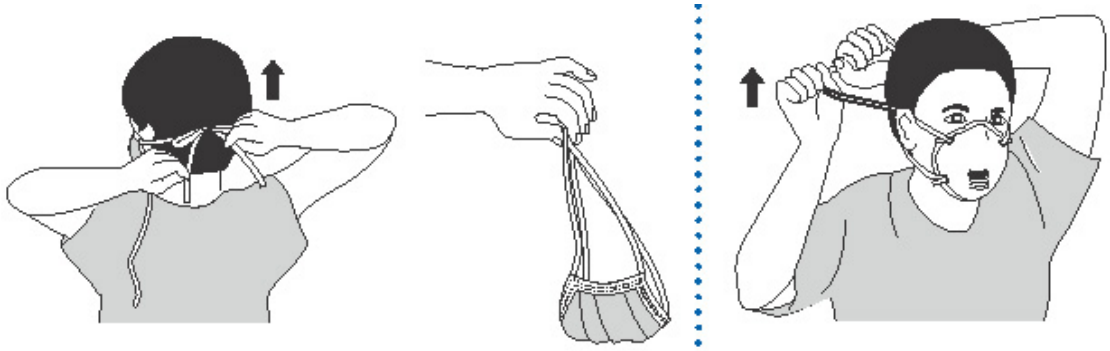
How to remove gown:

1. Gown front and sleeves are contaminated.
2. Unfasten ties.
3. Pull gown away from neck and shoulders, touching inside of gown only.
4. Turn contaminated outside toward the inside.
5. Fold or roll into a bundle and discard.



How to remove mask or respirator:

1. Front of mask is contaminated; do not touch.
2. Grasp bottom ties or elastics of the mask/respirator, then the ones at the top.
3. Remove without touching the front.
4. Discard.



Source: CDC, 2016e.

ENHANCED PRECAUTIONS AGAINST EBOLA VIRUS TRANSMISSION

The CDC provides guidance for healthcare workers who are caring for a person with confirmed Ebola or persons under investigation for Ebola. This guidance recommends:

1. Healthcare workers caring for patient with Ebola or persons under investigation for Ebola are required to receive comprehensive training and have demonstrated competency in performing Ebola-related infection control practices and procedures.

2. Personal protective equipment that covers the clothing and skin and completely protects mucous membranes is required:

    - A disposable **impermeable gown** extending to at least mid-calf or **coverall**, preferably without a hood. Coveralls with or without integrated socks are acceptable.

    - Disposable **apron** covering the torso to level of mid-calf should be used over the gown or coveralls if the patient is vomiting or has diarrhea. An apron should be used routinely if the facility is using a coverall that has an exposed, unprotected zipper in the front.

    - Disposable **examination gloves** with extended cuffs. Two pairs of gloves should be worn so that a heavily soiled outer glove can be removed and replaced safely during care.

    - Disposable **boot covers** that extend to at least mid-calf. Disposable ankle-high **shoe covers** worn over boot covers may also be considered. It is acceptable to use disposable shoe covers if they are used in combination with a coverall with integrated socks.

    - An **N-95 respirator** with a disposable surgical hood extending to the shoulders and fully covering the neck. Alternatively, a **PAPR** can be used that includes a full face shield, helmet, or headpiece and disposable hood.

    - Full **face shield.**

3. When personnel are providing care to patients with Ebola, they must be supervised by an on-site manager at all times, and a trained observer must supervise each step of every PPE donning/doffing procedure to make certain established PPE protocols are completed correctly.

4. Individuals who are unable or unwilling to adhere to infection control and PPE use procedures should not provide care for patients with Ebola.

Source: CDC, 2017a.

CLEANING AND DISINFECTING

All equipment and environmental and working surfaces must be cleaned and decontaminated after contact with blood or OPIM. Protective gloves and other PPE should be worn as necessary, and an appropriate disinfectant should be used. Such disinfections can be a diluted bleach solution or EPA-registered antimicrobial products such as tuberculocides, sterilants, or products registered against HIV/HBV.

When cleaning up a **blood spill,** use protective gloves or other PPE as necessary and:

- Wipe up the spill with paper towels or other disposable absorbent material and discard the contaminated materials in an appropriate, labeled container.
- Clean up all blood thoroughly before applying the disinfectant.
- Apply the disinfecting solution onto all contaminated areas of the surface.
- Let surface remain in contact with disinfectant for the number of minutes indicated in the manufacturer's instructions.
- When using a diluted bleach solution, contact time is the length of time it takes for the solution to dry.
  (CDC, 2016f)

Diluted bleach solutions can be made up in different strengths. The most common mixture contains 1 part 5% household bleach to 9 parts water. This will make a strong (0.5%) chlorine solution (CDC, 2015b).

HANDLING CONTAMINATED LAUNDRY

Contaminated laundry (i.e., soiled with blood or OPIM or that may contain sharps) should be handled as little as possible with a minimum of agitation. It should be placed and transported in bags or containers labeled or color-coded. When contaminated laundry is wet, it should be placed and transported in containers or bags that prevent soak-through or leakage.

Avoid uniform contamination by holding soiled laundry away from the body, and do not hold laundry bags close to the body or squeeze them when transporting to avoid punctures from improperly discarded sharps.

HANDLING REGULATED WASTE

Regulated waste refers to:

- Any liquid or semi-liquid blood or other OPIM
- Contaminated items that would release blood or OPIM in a liquid or semi-liquid state if compressed

- Items that are caked with dried blood or OPIM and are capable of releasing these materials during handling
- Contaminated sharps

Regulated waste should be placed in strong, leak-proof plastic bags or a container capable of being autoclaved and should be properly labeled.

Sharps Handling

Contaminated sharps are needles, blades (such as scalpels), scissors, and other medical instruments and objects that can puncture the skin. Contaminated sharps must be properly disposed of immediately or as soon as possible into containers that are closable, puncture-resistant, leak-proof on the sides and bottom, and color-coded or labeled with a biohazard symbol.

HOW TO HANDLE SHARPS

- Discard needle/syringe units without attempting to recap the needle whenever possible.
- If a needle must be recapped, never use both hands. Use the single-hand "scoop" method.
- Never break or shear needles.
- To move or pick up needles or other sharp devices, use a mechanical device or tool, such as forceps, pliers, or broom and dustpan.
- Dispose of needles in labeled sharps containers only; sharps containers must be accessible and maintained upright. When transporting sharps containers, close the containers immediately before removal or replacement to prevent spillage or protrusion of contents during handling or transport.
- Fill a sharps container up to the fill line or two thirds full. Do not overfill the container.

Source: OSHA, 2012.

POSTEXPOSURE MEASURES AND FOLLOW-UP

Emergency Steps Following an Accidental Exposure

If an **occupational exposure** to blood or other body fluids occurs, the following steps should immediately be taken:

1. First wash needlestick injuries and open wounds with soap and water.
2. Flush splashes to nose, mouth, or skin with water.
3. If exposed, irrigate eyes with clean water, saline, or sterile irrigant.
4. Report the incident to the supervisor.
5. Immediately seek medical treatment.
   (CDC, 2016g)

Employer Follow-Up

Following an **exposure incident**, the employer is required to:

- Perform a timely evaluation of the circumstances surrounding the exposure incident to find ways of preventing such a situation from occurring again
- Identify the source individual (unless the employer can establish that identification is not possible or prohibited by state or local law) and determine the source's HBV and HIV infectivity status
- If the status of the source individual is not already known, test the source's blood as soon as possible, provided the source individual consents
- If the source individual does not consent to testing, establish that legally required consent cannot be obtained
- If state or local law allows testing without the source person's consent, test the individual's blood, if it is available
- Make results of the tests available to the exposed worker and inform the worker of the laws and regulations concerning disclosure of the source's identity and infectivity status
- Provide a timely written report of the above information

Medical care as the result of an exposure is provided by the employer at no charge to the healthcare worker. All test records are confidential. The healthcare worker must be given a copy of the healthcare professional's written opinion within 15 days after the medical evaluation is finished. Postexposure prophylaxis may be administered if medically necessary, as recommended by the U.S. Public Health Service. The healthcare worker should also be offered counseling that includes recommendations for transmission and prevention of HIV (OSHA, 2012).

COMMON QUESTIONS ABOUT THE BLOODBORNE PATHOGENS STANDARD

Q: Are employees such as housekeepers, maintenance workers, and janitors covered by the Standard?

A: Yes. Housekeeping workers in healthcare facilities may have occupational exposure as defined by the Standard. Workers who perform housekeeping duties, particularly in patient care and laboratory areas, may be required to clean up blood spills and handle regulated waste, putting them at risk for occupational exposure.

Q: Do specimens have to be double-bagged?

A: Double bagging is only required if the primary container is contaminated on the outside. If a specimen could puncture the primary container, a secondary puncture-resistant container is required.

Q: Are gloves required to be worn when giving an injection?

A: No. Gloves are not required to be worn as long as hand contact with blood or OPIM is not reasonably anticipated.

Q: Are employers required to provide safety devices or alternatives to sharps such as needles?

A: Employers must annually consider and implement appropriate, commercially available, and effective safety devices or alternatives.

Q: Does protective clothing need to be removed before leaving the work area?

A: Yes. The work area is considered to be an area where work involves occupational exposure or where the contamination of surfaces may occur (e.g., patient rooms, laboratories).

Q: Are feminine hygiene products considered regulated waste?

A: No. The absorbent materials they are composed of, under most circumstances, prevent the release of liquid or semi-liquid blood or flaking of dried blood. They can be discarded into waste containers properly lined with plastic or wax paper bags.

Q: Must part-time and temporary employees be trained in the Bloodborne Pathogens Standard?

A: Yes. Part-time and temporary employees must be trained and be trained on company time.

Q: Are volunteers in the healthcare setting covered by the standard?

A: No. Volunteers are not covered by the standard.

CONCLUSION

Protection of healthcare workers against bloodborne pathogens is of vital importance. Healthcare workers need to have an understanding of how bloodborne pathogens are transmitted as well as the standards and precautions recommended to prevent exposure. Following OSHA's Bloodborne Pathogens Standard, including the use of Standard Precautions, can break the chain of infection, reduce the risk of exposure, and ensure a safe working environment.

RESOURCES

Guidance on Personal Protective Equipment To Be Used by Healthcare Workers During Management of Patients with Ebola Virus Disease in U.S. Hospitals, Including Procedures for Putting On (Donning) and Removing (Doffing) (CDC)
http://www.cdc.gov/vhf/ebola/hcp/procedures-for-ppe.html

OSHA Bloodborne Pathogens Standard
http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10051

PEPline Poster (CDC)
http://www.cdc.gov/niosh/topics/bbp/PEPline_poster.pdf

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TEST

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1. A circulating nurse in surgery is at **highest** risk for exposure to a bloodborne pathogen when working with which other potentially infectious material (OPIM)?

a. A tissue biopsy from a patient with active hepatitis B

b. The preservative used to fix a tissue sample

c. A cancerous tumor from a patient with breast cancer

d. The cleaning agent used to disinfect hard surfaces in the operating room

2. The OSHA Bloodborne Pathogens Standard requires employers to establish an exposure control plan, provide personal protective equipment, train employees, and:

a. Implement engineering controls to reduce risk of exposure.

b. Solicit employee input regarding the types of warning labels to be used on new products.

c. Offer employees prescreening for hepatitis B titer before administering the vaccine.

d. Establish a method of identifying the cost of exposure control practices.

3. A nurse is administering an intramuscular injection into the arm of a patient while appropriately using PPE and engineering and work practice controls. What is the potential means of transmission that poses the highest risk to the nurse in this clinical scenario?

a. Direct exposure to the patient's intact skin

b. Indirect exposure from a needlestick injury

c. Touching the patient's blood with a gloved hand

d. Being coughed upon by the patient

4. Which two microorganisms are considered **common** bloodborne pathogens that can cause disease in humans?

a. Syphilis and malaria

b. Hepatitis A and influenza

c. Zika and Ebola

d. Hepatitis B and HIV

5. Hepatitis B is **not** transmitted through:

a. Breastfeeding.

b. Sharing toothbrushes.

c. Birth to an infected mother.

d. Sex with an infected partner.

6. Which is a **correct** statement about the hepatitis B vaccine?

a. Employers must make screening a condition of receiving vaccination.

b. To ensure immunity, it is important to receive all three injections.

c. An employee may not take the vaccine later after initially declining it.

d. Hepatitis B vaccine offers the least protection from the disease.

7. Which is a **true** statement about hepatitis C?

a. The most common means of transmission in the United States is through injection drug use.

b. Prior infection protects against future infection with the same or different genotype of virus.

c. Most people with hepatitis C are well aware of their illness.

d. Hepatitis C is the least common bloodborne disease in the United States.

8. The **most effective** means of protection against HIV infection for healthcare workers is:

a. Appropriate handwashing and surface decontamination.

b. Use of needleless devices.

c. HIV vaccine.

d. Adherence to Standard Precautions.

9. Which is a **correct** statement about the Ebola virus?

a. Ebola virus can only survive outside the hospital for a few minutes.

b. Ebola virus is not found in breast milk.

c. Direct contact with contaminated clothing or bedding can transmit Ebola virus.

d. FDA-approved therapeutics are available for Ebola virus disease postexposure.

10. Which is a **correct** statement concerning the Zika virus?

a. Zika virus is only spread through the bite of infected mosquitoes.

b. Zika cannot be transmitted by sexual contact.

c. There are no signs or symptoms of infection with the Zika virus.

d. Zika can cause serious birth defects.

11. Which is a **true** statement about Standard Precautions?

a. The use of Standard Precautions is limited to settings where exposure to blood may be expected.

b. Before implementing Standard Precautions, it is advisable to determine if the patient is contagious.

c. Standard Precautions are implemented regardless of the perceived status of the source individual.

d. Engineering and work practice controls are not required if Standard Precautions are implemented.

12. What is the single most important practice in preventing the spread of infectious agents?

a. The isolation of infected patients

b. Hand hygiene

c. Prompt and thorough reporting

d. The use of gloves

13. Which is a **true** statement regarding PPE guidance when working with patients infected with Ebola virus?

a. PPE donning/doffing must be supervised by a trained observer each time.

b. Respirators are not required.

c. Double gloving is not recommended.

d. PPE guidelines recommend frequent disinfection of gloved hands using an alcohol-based hand rub.

14. When cleaning up a blood spill, what sequence should be followed?

a. Wipe up the spill first with paper towels and place dirty paper towels on a clean surface.

b. Apply disinfecting solution directly to the blood and then wipe up with paper towels.

c. Clean up all blood and then apply a disinfectant.

d. Wipe up all blood and then rinse the area using only an EPA-registered antimicrobial product.

15. Which are the appropriate actions to take in the event of an accidental needlestick injury?

a. Cleanse the injury with alcohol wipes and immediately seek medical treatment.

b. Report the incident immediately to the supervisor and then wash the injury.

c. Wash the needlestick injury with soap and water and report the incident to the supervisor.

d. First irrigate the injury with sterile irrigant, followed by soap and water.